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EDITORIAL

The History of Nickel

THERE are many who will agree with Sir Gowland Hopkins in the suggestion he made recently that the history of science might find a more prominent place in the teaching given in schools and universities. If the student should feel any misgivings as to the interest of the subject he might find reassurance in the history of nickel. We make the suggestion after reading of a speech broadcast in Canada by Mr. R. C. Stanley, of the International Nickel Company, on the occasion of the fiftieth anniversary of the discovery of the nickeliferous pyrrhotines of the Sudbury district, in Ontario. Nickel was of course used for many years before this discovery; the Chinese many centuries ago used a copper-zinc-nickel alloy which they called "pakfong," and it is now nearly two hundred years since Cronstedt discovered the metal as a new element in the mineral now called niccolite, then known to the miners of Saxony as "kupfernickel," or false copper, since although it appeared to be a copper ore they were unable to extract copper from it; the metal found also an extensive application in electroplating following Faraday's discoveries a hundred years ago. It is however the research work undertaken since the discovery of the ore in Canada that has been responsible for the position of eminence which the metal now holds amongst the materials used by the engineer. The many uses of nickel to-day need no emphasis here; condensed and in tabulated form they are sufficient to fill sixteen pages of a booklet recently issued by Henry Wiggin & Company, and the monthly bulletin of the Mond Nickel Company usually tells us of some new or extended use of nickel or its alloys. Yet there was an element of chance in the finding of the Sudbury ores, and if it had not been for the construction gangs blasting the way for the Canadian Pacific Railway their discovery might have been postponed many years. The first exploitation which followed the discovery had in mind only the value of the copper, but the nickel could not be ignored and in course of time it became available in such quantities that further uses had to be found for it. The early workers could hardly have imagined that the metal, then something of a nuisance, would become so important or so valuable. The original mining claim at Sudbury was purchased for a dollar an acre, and has since yielded metals to the value of more than half a billion dollars, whilst the area has become one of the world's most important sources of platinum, palladium, and other precious metals. The history of science is traversed by many such by-ways, which well repay those who trouble to explore them.

Sulphate of Ammonia

The manufacture of sulphate of ammonia is a noble industry and the distribution of this important article employs a multitude of men and women. It is the duty of scientific people to encourage such enterprises and this is a season when we shall have a little leisure to study our lawns; it is also a season when the weeds put forward their tender flowering shoots and there is no close season for weeds during their breeding period. A long series of careful experiments has convinced us that the expenditure of eighteen pence on sulphate is extremely beneficial to a plot the size of a tennis lawn; this may be taken as standard practice, and if a million people made such a purchase at suitable intervals it is easy to calculate, with the help of a slide-rule, what profits will enure to the benefit of the I.C.I. and our leading gas companies. There are two good ways of applying the crystals to a lawn; one is, immediately after breakfast, when the wife is not looking, to slip a tea cup and a tea spoon into your coat pocket, and then to walk on to the lawn with a jaunty air, leaving her busily counting the implements left on the table. A teaspoonful of sulphate will kill almost any weed, all but the most hardened sinners of weeds, besides which it stimulates the grasses in the immediate vicinity. The other way, when weeds are weary and few, is to meander about the lawn pattering your prayers or reflecting on the Chemical Society's Discussion on "Substitution in Organic Compounds" (see p. 467 of this issue) and ever and anon as you see a weed, mark the place with your hat, or pipe, or pouch, and then go to the store and bring back with you a pinch of the crystals. In this way you combine intellectual improvement with moderate exercise and surely eighteen pence spent in this manner will be grudged by no one. Perhaps those professionally engaged in the study of the treatment of lawns have some further refinements to suggest; if so we hope to hear from them after Whitsuntide. We have purposely refrained from discussing the applications of solutions of sulphate, upon which we have long made observations

APPLICATION OF THE HALOGEN DERIVATIVES OF THE HYDROCARBONS WITH PARTICULAR REFERENCE TO METHYL BROMIDE

By ALBERT HENNING

In my paper published in the Proceedings of the Fourth International Congress, 1924, I dealt more or less exhaustively with the properties of certain halogen derivatives of the hydrocarbons. I now furnish information relating to what these halogen derivatives can be made to do in new directions, and I have obtained the knowledge from tests carried out during the last ten years.

Before proceeding further into the prospective uses of these products, I would like it to be borne in mind that they should be used in a neutral state, possessing where required a non-inflammable property.

In my paper presented to the Society of Chemical Industry in 1920, besides dealing with refrigeration I chiefly concerned myself with the manufacture of intermediates for dyes by the process of ethylation by ethyl chloride. Before this process was adopted close upon ten years elapsed, but in the end many hundreds of tons were used. This successful mode of ethylation did not at once lead manufacturers to adopt a similar process employing the methyl or bromide compounds in the manufacture of other series of dyes.

I have since been engaged in continuous experiments, from the results of which the following stands out: The rendering of ethyl and methyl chloride non-inflammable for refrigerating and other purposes. The non-inflammable property of my refrigerant served to save the lives of several attendants in a ship's hold. A non-inflammable refrigerant, apart from its value in general use, should prove specially valuable where a plant is exposed for exhibition purposes or used in, say, a farm building, where hay, straw, and other combustible matter is near at hand. For example, refrigerators working on the cooling of milk should be so supplied.

The discovery of this non-inflammable refrigerant led to my making tests on a large scale for the extinction of fire with methyl bromide alone. By doing this the possibility of producing phosgene by decomposition was excluded. When I started to manufacture methyl bromide I thought it wise to test if there were any dangerous amount of toxicity to be feared when work people came near it. Among other tests, the following were made:

1921.—Half a gallon of methyl bromide (8½ lb.) was spilt on the floor of a waiting room of dimensions 11 ft. by 6 ft. by 9 ft. Three people, including myself, were present and the doors were closed. We remained 20 minutes, from 11.46 a.m. to 12.6 p.m. Two people sat down most of the time, but we did not always remain motionless. Lighted matches went out about 4 in. from the floor.

Cubic feet of air in room, about 600. Cubic feet of methyl bromide in room, about 30. Cubic feet of space, 4 in. from bottom of floor, about 22. Methyl bromide gas is 3¼ times as heavy as air.

Effects: Pulse normal after 20 minutes' exposure. Respiration normal after 20 minutes' exposure. Cold feet from drop of temperature. Room temperature was 56° F. (about 13·5° C.). I had a drink of half-and-half whiskey afterwards but there were no intoxicating effects.

1925 *laboratory test.*—A test was made to discover any signs of being affected with coughing, headache, anæsthetic symptoms, etc. in a small laboratory of dimensions 12 ft. by 10 ft. by 9 ft., with two men and two women present. For about a quarter of an hour methyl bromide was poured on to a lighted gas fire, which of course, had to be repeatedly re-lighted. Whitish fumes arose and clung around the ceiling and down to within a foot of the ground. All doors and windows were shut but no one felt any inconvenience and there were no after-effects. The experiment was carried out at about 2.30 p.m., after the midday meal.

1926 *open air test.*—At an open air test, where from 30 to 40 gallons of methyl bromide were projected on to burning petrol, and afterwards when full and partly empty containers were collected for about half-an-hour, not one of the persons present noticed any inconvenience.

Test of the Royal Aircraft Establishment at Farnborough.—A mock crashed aeroplane consisting of metal fuselage, wings, engine, radiator, and tank, stuffed with petrol-soaked tow—dimensions approximately 30 ft. by 30 ft.—over the whole of which additional petrol was pumped at the rate of 15 gal. per minute was extinguished by hand without mechanical appliances by three operators in 1 min. 20 sec.

Another severe test was the extinction of 7000 ft. of unrolled cinema film in the open within a minute of being in full blaze. The smouldering of the film, a rather difficult matter to overcome, was conquered in a few seconds by about one quart of the refrigerant or fire extinguisher, methyl bromide; a thick coating of ice was formed over the mass and prevented the continuation of smouldering or rebursting into flame. Hundreds of other tests have been made with different inflammable substances, solid, liquid, and gaseous.

When observing extinguishing appliances employing methyl bromide mixed with various substances, I have come to the conclusion that first of all I would eliminate such substances as carbon tetrachloride and pentachlorethane, which are not self-propelling at normal temperatures and which are known to produce phosgene. They are a useless weight and only weaken the power of the spray by having to be carried to the flames. Further, the addition to the main fire extinguishing liquid of products such as compressed nitrogen or carbon dioxide is a troublesome proceeding. They must be confined in vessels of greater strength, weight, and costliness than would be otherwise required. Methyl bromide at a temperature of 15° C. will spray to a distance of 20 ft.

Methyl bromide is safe in tropical heat (122° F.) in metal containers tested to 80 lb. per sq. in. as the gauge pressure of methyl bromide at that temperature is 55 lb. A curious fact was observed at a later date concerning the application of methyl bromide. Although it produces a temperature of −60° C. (−76° F.) in less than a minute as a spray, this liquid can be made to raise the temperature in one minute from 15° C. (59° F.) to 90° C. (194° F.) in a metal cylinder.

Therefore, in some types of refrigerating machine methyl bromide *could be made to produce cold on one side* and heat on the other to replace auxiliary heating done by *an electric light, gas, or other flame. In aeroplanes,* submarines, automobiles, etc. the rapid generation of heat or cold is periodically required and the sudden alteration of temperature can be brought about at very small cost and at such intervals as may be desired. No separate machinery is necessary nor are heavy weights involved.

By employing suitable means, these hydrocarbons lend themselves advantageously to degreasing wool or to other fat extractions. The work is done without the heavy and cumbersome machinery at present in use. As an example, the cost of degreasing wool is reduced to less than half the present figure. A large test was made with wool. An open galvanized tank of 500 gal. capacity contained the hydrocarbon and the wool to be degreased. A large Yorkshire mill turned the wool into tops etc., and finally made it into blue cloth, also making a comparative test by producing cloth from the same kind of wool soap and water scoured in the old way. The results were tabulated and favourably reported on by the University of Leeds and the mill. *The samples of tops, threads, and cloth are available* for inspection.

No effluent has to be provided for in this system yet valuable substances such as lanoline are retained. The *usual operations after degreasing are done in the present* way and the machinery used is not in any way interfered with, but the following advantages accrue: There is a gain of wool; the fibres possess greater elasticity and the strength of the finished cloth is increased in both the warp and weft threads; there is a saving of motive power and less labour is involved; this process is invaluable in arid countries.

In using my cold extraction process for collecting the oil contents of nuts, seeds, flowers, etc. no fatty acids are developed. This is a very great advantage. The cleanliness of the operations, both as regards fibres and vegetable and animal products, is outstanding and no offensive residues have to be collected or shut out. A plant for manufacturing the solvent and at the same time extracting fats and then again reconditioning the original liquid can be designed.

Much has been written concerning the poisonous nature of the halogen derivatives of the hydrocarbons. Mishaps and even fatal cases are mentioned. I have spent considerable time in perusing the statements *originating in continental countries and the United* States, and can emphatically state that in the course of over twenty *years* I have *never met with any such* cases in this country.

I will mention only two industries, viz., *refrigeration* and fire extinguishing. If the builders of refrigerating plants construct them *in* such a *manner* that the derivative cannot escape there can be no mishap. I have not found a single case where methyl bromide used on a fire as a fire extinguisher resulted in a minor or fatal injury. I do not see how such a mishap can occur. No one would stay in a room where a fire was extinguished because of the fumes caused by the combustible matter itself and the smoke. If a room is full of fumes from burning paint, lacquer, etc. or ordinary smoke, no *one remains in it.* Various *objections* have been raised against the use of methyl bromide as a fire extinguisher, *but there is no evidence that methyl bromide* used for this purpose has caused any trouble at all. All the *mishaps* and *fatalities were caused not by methyl* bromide in its pure state but by workmen attending to repairs in defective plant and remaining exposed for a length of time to chemical fumes, not necessarily methyl bromide fumes. Persons acquainted with large size chemical plant know that there is a vast difference between the fumes of various ingredients at the start and the fumes of the finished chemical.

That methyl bromide of various qualities, especially dangerous qualities, has been supplied is unquestionable. For instance, purchasers insist on what they call a commercial quality, that is, a liquid which has not been thoroughly freed from impurities or in the making of which inferior ingredients have been employed. Pure methyl bromide has a boiling point of 4·5° C., a specific gravity of 1·73, and is non-inflammable.

Delayed action in the production of serious symptoms in the worker is also met with a very large number of chemicals of this type. Many chemical and pharmaceu*tical products show like action. The word "poison"* is used in a very loose manner as the layman does not *know that poisoning is a matter of dosage* and idiosyncrasy. Lead, chloroform, alcohol, opium, nicotine, etc. *produce their special symptoms* after different lengths of time.

My firm was the first to put down ethyl chloride, ethyl bromide, methyl chloride, and methyl bromide plants in this country. These plants are enclosed and men are constantly working around them night and day. The yields are not small as they range from 50,000 to 100,000 lb. per annum. All the employees have been at work with us for over ten years, and in fact when suffering from an incipient cold go into the plant room to get rid of it.

It is my opinion that commensurate with progress made in other directions, the gentle art of fire extinguishing has lagged heavily behind. Roughly speaking, if 30s. is spent on the manufacture of a metal container not 30d. is spent on the extinguishing liquid. Such fire extinguishers really give a false feeling of security. The cost ratio should be the other way about. There is the house of six to twelve rooms or more and only one fire extinguisher. *On the outbreak of a fire it will be a* thousand to one whether the fire extinguisher is anywhere within *reasonable distance. Then there is the delay of* getting it ready and using it, whereas if half-a-dozen *small hand extinguishers* were *distributed all over* the house there would be no fires. They would be extinguished before they could get a fair start, and the loss of property, but much more than that, the destruction of life or bodily mutilation, would be avoided.

For large factories and hotels, rather than have coils of hose piping and expensive perishable fittings very often stored in dark corners and stuck about with illegible instructions, there should be 5 to 10 gal. of a self-spraying liquid such as methyl bromide which would be ready for use in less than a second, and the container

of which would be so mounted as to be readily movable from place to place.

The following instance shows the immense value of methyl bromide as a fire extinguisher. In the hold of a vessel lying in the docks, the engine room, about 14 ft. square, contained several engines and other machinery, together with a refrigerating machine charged with methyl bromide. The room was lighted by two large oil lamps suspended from the ceiling and several men were at work. The gauge-glass of the refrigerating plant was accidentally broken by a spanner and about four gallons of the refrigerant rushed out, filled the room with gas and immediately plunged it into darkness by extinguishing the two hanging lamps. The men's lives were saved thereby. If the refrigerating machine had been charged with an inflammable liquid it would have meant death to everyone present, as there was other inflammable matter in the ship's hold. I saw the men the next day and on the days following. I learnt that the refrigerant made them cough and splutter a little and their clothes were covered with hoar-frost, but they climbed an iron ladder on to the deck and experienced not the slightest inconvenience then or afterwards.

I will not go into the question here of accidents and fatalities that occur in the manufacture of these halogen derivatives or whilst they are being used as intermediates in the dye industry, in the preparation of fine chemicals, etc. I have never met with such cases. Perhaps the reason is found in the safe working of my own plant and the care of the men in carrying out the instructions thoroughly taught them. It must be apparent that a manufacturer of these hydrocarbons in bulk comes across incidents which do not happen in the laboratory, or in research work which sometimes is only spread over a short period and involves the use of small quantities only. The manufacturer's work is never finished, that is, it is subject to alteration or modification here and there as he finds it beneficial.

My information is derived not from testing a few pounds but from continually making tests with tens of thousands of pounds of the various products during the course of 20 years, whilst working with plant 100 ft. in length and of 3000 gal. capacity.

I have particularly reserved a small portion of this paper for dealing with fire extinguishing. There are many chemicals used in this comparatively modern industry, and I trust that I shall be pardoned if I have shown the defects of some of the products in use and suggested alterations or improvements in them.

As will be seen from the above, I am favoured by lengthy experience and large amount of production in speaking of the supposed difficulties or dangers in the processes of manufacture.

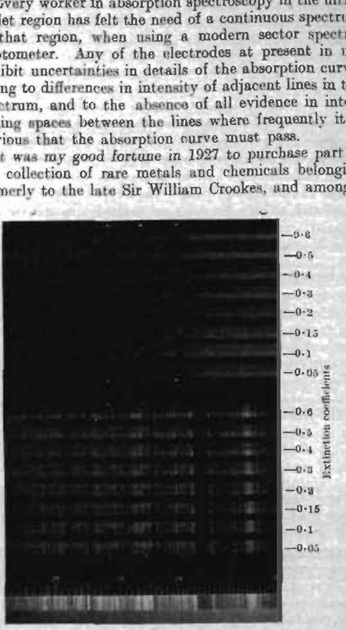
If, after reading this paper, there are still people who do not agree with me as to the safety of workers in these chemicals, I would say that any actual danger is due to primitive plant or gross carelessness of the attendant. They should also remember that all mishaps and fatalities are described as having taken place on the Continent and in the United States. I have been unable to trace any in this country or in countries to which our product has been exported.

URANIUM AS A SOURCE OF CONTINUOUS ULTRA-VIOLET RADIATION

By S. JUDD LEWIS, D.Sc., F.I.C.

Every worker in absorption spectroscopy in the ultra-violet region has felt the need of a continuous spectrum in that region, when using a modern sector spectrophotometer. Any of the electrodes at present in use exhibit uncertainties in details of the absorption curve, owing to differences in intensity of adjacent lines in the spectrum, and to the absence of all evidence in intervening spaces between the lines where frequently it is obvious that the absorption curve must pass.

It was my good fortune in 1927 to purchase part of the collection of rare metals and chemicals belonging formerly to the late Sir William Crookes, and amongst



the treasures were two small pieces of compact uranium metal. With these I produced a spark in the usual way and found that the spectrum was continuous and useful as far as 2100A and indeed beyond. The uranium lines were so very thin and so feeble that they disturbed the sense of continuity very little. The two specimens were small, and so they were reserved for special occasions only. In this country, on the Continent, and in America I endeavoured to obtain further specimens, but without success, nor could I induce anyone to make suitable rods, and therefore I made experiments with mixtures of uranium oxide and reducing metals to obtain a similar spectrum, but the results were not satisfactory. The gap has been bridged recently by the introduction of what one must regard as the ideal in ductile uranium, and this can now be purchased in the form of small rods suitable for use in spark lamps.*

Advantages to be derived are evident from the accompanying photograph, taken by means of a "Judd Lewis" sector photometer and a medium Hilger quartz

* They are supplied by Adam Hilger, Ltd., London.

spectrograph. The figure exhibits eight comparison spectra, of benzene in hexane (1 in 5000, in a 1-cm. cell), (*a*) taken with the new uranium electrodes, (*b*) taken with tungsten-steel electrodes. The absorption bands (marked with dots) are clearly evident in the lower spectrum of each pair in the former case, but difficult to recognize, although equally present, in the latter. The two series were taken under conditions of exposure, photometry, etc., identical in all respects. The pair of spectra at the bottom of the figure are direct photographs without the intervention of a photometer; they show therefore, the differences in quality between the two spectra.

With uranium the points of equality in the upper and lower bands in each pair are so sharp that it is difficult to mark the plate by pen with adequate precision, even when using very small dots. The utmost precision may be attained by making the observations through a comparator against a suitable spectrum used for calibration.

Another feature in which the new electrodes are of particular value is in determining points of equality corresponding to those in the parts of the graphs which are nearly horizontal.

Continuous spectra in the ultra-violet are obtainable by an aluminium arc run under water, and by some other means which are very inconvenient: the uranium electrodes are used in the open air under ordinary conditions of laboratory practice.

THE PAINT RESEARCH STATION

On May 25 the president and council of the Research Association of British Paint, Colour, and Varnish Manufacturers held a reception at the Paint Research Station, Teddington, Middlesex, and many members of the Association and other distinguished chemists were given an excellent opportunity of seeing the laboratories and of examining the work at present in progress. In the afternoon the visitors were able to hear an address by Dr. W. Krumbhaar, director of the Institut für Lackfosschung, Berlin, and the library and adjoining office were well filled for the occasion.

For those chemists present who had not an intimate knowledge of the work of the Paint Research Station the researches must have been agreeably surprising in their wide scope and usefulness. The building has two storeys, with offices, physical laboratories, a technical laboratory, and library on the ground floor, with chemical laboratories, a second technical laboratory, and museum on the first floor, whilst the roof is used for natural weathering tests. In the physical laboratories the visitors were able to see the apparatus for glass measurement by the optical and photo-electric methods, the methods in operation for determining hiding power of paint, whirling tables for the preparation of experimental smooth-coated panels, microphotographic apparatus in use for measuring particle size of pigments, and apparatus for measuring viscosity and plasticity.

In the laboratories dealing with colour measurement an interesting exhibit was the Guild Trichromatic Colorimeter, by means of which colours are measured in terms of their content of three spectral primaries, red, green, and blue, and their brightness at the same time estimated by reference to a magnesium-oxide screen under standard conditions of illumination. The B.D.H. pattern of the Lovibond Tintometer and the Eastman-Kodak colorimeter are also used in the physical laboratories, whilst colour-fading is determined by the K.B.B. Fugitometer, which consists of a carbon arc enclosed in glass partially transparent to ultra-violet, with means for controlling the humidity of boxes in which colours are exposed. Other exhibits in this section included a comparison of the colouring power of various pigments, including a series of ultramarines, the changes in colours of oils on heat treating, and a number of pieces of apparatus for testing durability of finish, resistance of patent leathers and coated fabrics to cracking, and determination of drying time of paints.

The artificial weathering equipment was of special interest. It consisted of two weathering tanks containing arc lamps, and in each tank a water spray was directed along a fixed radius, the tanks being slowly rotated. Rain water was used for the spray, and additional equipment allowed the test panels to be subjected to alternations of temperature. Typical exposure panels obtained in this way were shown in comparison with similar panels which had been subjected to natural weathering.

The six chemical laboratories contained many interesting exhibits. In one laboratory work on tung oil was proceeding, from experimental pressing of the tung-oil fruits to the investigation of polimerization, and a small-scale solvent-extraction plant was in operation. In another room the dispersion of certain azo-dyestuff pigments was shown, together with some illustrations of their properties, *e.g.*, their fastness to light, shown comparatively after exposure to the carbon arc. Here too the preparation of soft-textured Prussian blues was shown, and the manufacture of lead chromes, examples being given of chromes which do not blacken in sunlight: the rapid testing of chromes for blackening, by means of the mercury-vapour lamp, was shown in another room. Experiments were also shown illustrating the wetting and dispersion of pigments, aqueous, oily, and emulsion media being demonstrated. A large number of exposure panels was shown in connexion with the work on weathering, effect of primers and undercoats, variation of media, and some excellent microphotographs showed good examples of crater bloom, crystalline bloom, and wrinkling. Many other examples were to be seen of the work in progress at the Research Station, of which we have been able to mention briefly only a few. The exhibition of researches must have impressed many with the very great attention to detail on all the matters in hand, and the practical significance to the paint industry of all this work.

In his address to the visitors Dr. W. Krumbhaar discussed the properties of chlorinated rubber, and concluded that whilst a strictly limited field of application was possible, the material could not be said to have fulfilled the hopes which were optimistically held out for it. In the second part of his address Dr. Krumbhaar compared the commercial and scientific activities of the paint industry with those in Germany. The papers on both subjects will be published subsequently in the JOURNAL.

MR. MEURIG LLOYD DAVIES

Meurig Davies, consultant and technical chemist, of Toronto, Canada, president of the Standard Chemical Co., Ltd., and director of the North American Chemical Co. and other industrial concerns, was born at Liverpool, England, in 1865, and was educated at Liverpool College. His early training in chemistry was obtained in the works of the famous old chemical manufacturing firm of James Muspratt & Sons, of Liverpool, of which he became managing director in 1890, the year of its absorption into the United Alkali Co. Three years later he became manager of the Hutchinson works of the company at Widnes.

During these years Mr. Davies had been taking a keen interest in the activities of the Society. He joined the Society in 1886, and at one time served on the committee of the Liverpool Section, a worthy position for one associated with the Muspratt family, who had taken such a prominent part in the founding of the Society.

In 1899 Mr. Davies left this country to take up the post of managing director of the North America Chemical

Co., of Bay City, Michigan, and he retained this position until 1913, when he left America to become general manager of the Standard Chemical Co. of Toronto, of which he became president in 1924. He is now also an honorary consultant of Imperial Chemical Industries, Ltd.

Chemists in Canada, and members of this Society in particular, are indebted to Mr. Davies for his keen interest and work over a period of many years. In 1922—24 he served as chairman of the Toronto Section, whilst the fact that his efforts on behalf of Canadian chemists are well appreciated has been shown by his election to the presidency of the Canadian Chemical Association for 1932—33. He has given advice to many a young graduate seeking to find a place in the chemical industry, and has always stressed the value that accrues to chemists through associations with other chemists and industrial workers.

SOCIETY OF CHEMICAL INDUSTRY

OFFICIAL NOTICES

Ottawa Section : Change of Address. The Hon. Secretary of the Ottawa Section, Mr. F. E. Artlett, has changed his address to Food & Drug Laboratory, Sussex & John Streets, Ottawa, Canada. The new address applies also to Messrs. H. M. Lancaster, R. D. Whitmore, James Dick, and A. L. Davidson.

John Gray Jubilee Scholarship. The scholarship is of the approximate value of £72 and is tenable for one year by a post-graduate worker at an approved seat of learning or research. Candidates at the time of application must have the intention of entering industry: preference will be given to sons of members of 10 years' standing. Undergraduates preparing to sit for their final degree examinations are eligible.

Applications should be addressed to the General Secretary, Society of Chemical Industry, 46, Finsbury Square, London, E.C.2, before June 30 and should furnish particulars of school and university careers and give references to persons who will testify to candidate's character.

FOOD GROUP

The annual general meeting of the Group was held on Friday, May 26, at the London School of Hygiene and Tropical Medicine, when the officers and committee for the session 1933—34 were elected as follows: *Chairman:* Dr. L. H. Lampitt; *Vice-Chairman:* Mr. B. G. McLellan; *Hon. Secretary:* Prof. H. Raistrick; *Hon. Treasurer:* Dr. H. E. Cox; *Committee:* Messrs. E. B. Anderson, J. B. Cronshaw, E. B. Hughes, D. W. Kent-Jones, H. J. Page, T. Rendle, T. Moran, J. Stenhouse, J. C. Drummond, Osman Jones, A. L. Bacharach, and J. W. Corran. Mr. T. McLachlan and Dr. A. Green agreed to serve as auditors of the accounts of the Group.

In his report on the work of the session, Prof. Raistrick, honorary secretary, stated that the year had shown a very gratifying increase in membership of the Group, 131 new members having joined, the total number now standing at 294. For a body a little more than a year old these figures indicated the importance of the subject both within and without the Society, for a considerable number of members had joined the Society in order to participate in the proceedings of the Group. Apart from the influx of about 40 members from the staff of Messrs. Lyons & Co., the growth curve was very steady and would no doubt continue so for some years to come. The Group's importance and the value of its work would undoubtedly improve in relation to its increasing membership.

A longer programme than the committee considered desirable in any but a first year was successfully carried out. Many of the meetings took the form of joint meetings with other bodies or with local sections or groups of the Society. Nine meetings had been held altogether and before the session closed two extra meetings would have taken place. At the annual congress of the Royal Sanitary Institute to be held this year in Blackpool, June 17 to 24, the Group had undertaken the organization of Section "F" Hygiene of Food. Dr. L. H. Lampitt was chairman of the section, and would preside over a joint discussion on "The Wrapping of Bread and Butter."

The Group was also organizing a session during the annual meeting of the Society at Newcastle in July, when there would be a discussion on "How Science can Help the Nation to Improve Its Own Food Supply."

Dr. H. E. Cox, as honorary secretary of the committee arranging the symposium on "Bread and Milk" to be held in London on November 23—24, stated that many eminent men would be present, and the success of the symposium was assured. Three sessions would be held, and twelve papers presented, and a dinner would be held in the Hotel Russell.

Prior to the annual meeting a joint meeting of the Group with the Metropolitan Branch of the Society of Medical Officers of Health was addressed by Dr. Haldin-Davis on "The Prevention of Industrial Diseases of the Skin." Dr. Haldin-Davis described the incidence of anthrax, skin cancer, chrome cancer, and dermatitis in industry, the measures adopted for the prevention and control of these diseases, and the legal requirements concerning them. A number of interesting slides were used by the lecturer to illustrate his paper, which it is hoped to publish in a subsequent issue of the JOURNAL.

Following the annual general meeting, a cinematograph film was shown illustrating the production of jams, jellies, and canned fruits and vegetables, in the factory of Messrs. Chivers & Sons, Ltd., Histon, Cambridgeshire, and an interesting comparison was provided by a film taken in the same factory 25 years ago.

CHEMICAL SOCIETY

The following is a continuation of the report of the discussion on "Substitution in Organic Compounds," held at Leeds on May 12 (see p. 433).

Prof. G. M. Bennett has communicated the following summary of his opening of the discussion, in place of that already published:

When the nuclear substituents *X* in a number of substances $X{\cdot}C_6H_4{\cdot}S{\cdot}C_2H_4{\cdot}Cl$ (Baddeley and Bennett, J., 1933, 261) are arranged in the order of their influence on the reactivities of these substances with (*a*) water and (*b*) potassium iodide, they form two series in which there is (*a*) a continuous rise, and (*b*) a continuous fall of inductive effect of *X*, the reactions being of Ingold's types *A* and *B* respectively. The halogens as a group fall into their correct place in each series, and for reaction (*b*) the order of the halogens within the group is normal, but for reaction (*a*) the order within the halogen group is definitely inverted.

An anomaly of this kind in the order of the halogens occurs in many cases, and was pointed out by Shoppee (1930—1932). It is clearly shown in the velocities of hydrolysis of substituted benzyl halides and benzoic esters and in the order of the strengths of substituted anilines and benzoic acids.

These facts are shown to point to the operation of an "electromeric effect" (in some cases deactivating and therefore presumably permanent) which varies in intensity among the halogens in the order $F > Cl > Br > I$. This is regarded as a butadienoid electronic displacement promoted by the outer electron-repelling fields of the halogen atoms, which should vary in this order, the order of their inductive effects. The commonly accepted view of the origin of the electromeric effect in chlorobenzene involving an increase of covalency between the chlorine and nuclear carbon atoms is rejected for various reasons, but particularly because it requires that the effect should be in the order $I > Br > Cl > F$, and that it should be of negligible strength for F.

Prof. R. Robinson has communicated the following summary of the paper read in his absence by Dr. J. C. Smith with the request that it may be substituted for that already published:

The Relation of Electromeric Effects and Relative Polarisabilities of the Halogens. [R. ROBINSON.]

Exception is taken to the view recently propounded by Baddeley and Bennett that the electromeric effects of the halogens differ in origin from those of ternary nitrogen and bivalent oxygen, and should be attributed to the repulsive effect of the outer electrons of the halogen atoms on the electrons in the aromatic nucleus. It is pointed out that none of the reactions cited by Baddeley and Bennett in support of their views is such that the electromeric systems play an important rôle in the actual processes involved, and it is thought that information about the electromeric systems should preferably be sought from a study of those changes in which they participate directly, and in which the unshared electrons set free by the electromeric changes are concerned in the formation of new co-valencies.

An alternative explanation fitting most of the cases brought forward by Baddeley and Bennett takes cognisance of the relative polarisabilities or deformabilities of the halogen atoms, these being in the order $I > Br > Cl > F$. In all those cases where a side-chain reaction either in its initiating phase or at a subsequent critical stage, requires an electronic displacement opposed to the electromeric *or* inductive effect of the halogens, the greater polarisability of the heavier halogens may theoretically produce a reversal of the anticipated order of either the electromeric or inductive effects. Either will serve to accommodate the phenomena, second-order effects most of them, adduced by Baddeley and Bennett in support of their new mechanism. The paper included a discussion of a number of further points in connexion with which Baddeley and Bennett's suggestions were considered to be open to criticism.

The Chlorination of Sodium Benzoate. [J. C. SMITH.] (Communicated.)

Holleman and Bornwater (Rec. trav. Chim., 1912, 31, 231) showed that the chlorination of benzoic acid with (liquid) chlorine in presence or iron produced about 70% of *m*-chlorobenzoic acid. The amounts of *o*- and *p*-isomeride could not be determined.

According to Lossen (D.R.P., 146,174; Friedländer's Fortschritte, 1902, 7, 115) hypochlorites react readily with sodium benzoate in dilute aqueous solution giving "the three chlorobenzoic acids side by side and especially the ortho-, the meta- being in small quantity."

Flürscheim and Holmes (J., 1926, 1565) drew attention to this effect of ionisation, the overpowering effect of a polar charge controlling the orientation.

(Compare the nitration of amines and of ammonium salts.)

Under the impression that the orientation in the case of sodium benzoate was *o*- > *p*- > *m*-, Flürscheim and Holmes speak of the "direct neutralisation of residual affinity between *para* atoms resulting in the *direct* transmission of the polar effect from the substituted atom to the *p*-atom," in other words, the *para*-bond benzene transmits the effect.

Actually, repetition and extension of Lossen's experiments has shown that the orientation in the benzoate ion is *o*- > *m*- > *p*-. This is most easily explained as orientation by the negative charge situated near the COO group diminishing with distance from that group.

In the discussion, Dr. Smith said that in his paper Prof. Bennett stresses the effects of *p*-halogen on the rate of hydrolysis of benzyl bromides, and brings forward data on the strength of halogen-substituted anilines as bases.

The fact that *p*-bromoaniline is a stronger base than *m*-bromoaniline is easily understandable, since with the *para*-isomeride the electromeric effect of the halogen causes electron accession to the nitrogen atom. In consequence the proton is less easily lost than from the *m*-isomeride where the electromeric effect is almost inoperative.

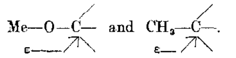
The fact that *p*-chloroaniline is a stronger base than *p*-bromoaniline is easily brought into line by applying the idea of increased deformability of the heavier halogen. In these cases the electromeric systems terminating in halogen and nitrogen are opposed.

The *p*-halogenobenzyl bromides are admittedly examples of the hetero-enoid (or allyloid) systems, but the electromeric effect of the *p*-halogen atom may suffer a check at the $-CH_2-$ group in certain phases of the reactions.

Actually, the reactivity of *p*-halogen substituted benzyl bromides (F > Cl > Br > I) is not inconsistent with the views expressed in Prof. Robinson's paper since the relatively less easily polarisable fluorine atom may well be less responsive than iodine to effects generated in the side-chain group ($CH_2 \cdot Br$) thus virtually exercising a greater electromeric effect. The phases in question are probably not those concerned with the initiation of the hydrolysis, but they may be of equal importance in determining the completion (and rate) of the process. But the whole of the circumstances surrounding these reactions have not yet been sufficiently investigated.

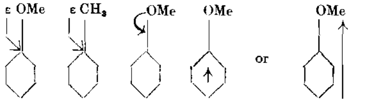
Dr. G. N. Burkhardt said: Mr. Evans and I suggest that some of the difficulties in the theoretical interpretation of these organic data arise from the conceptions of the Lewis–Langmuir theory and that it is just becoming possible to take advantage of quantum views in this sort of problem, largely owing to the developments made by Mulliken.

The particular change of view we are considering is that quantum conceptions require that the co-called "unshared" electrons in, *e.g.*, $:NR_3$, are contributing to the linkages between the nitrogen and the groups R, and so will affect the static or average properties of these groups. When one of the groups is phenyl this phenomenon is clearly related to the factor which has been called the "permanent component of the electromeric effect" and has been prominent in this discussion, but these electrons will also be involved to a certain extent in the linkages between, *e.g.*, nitrogen and saturated groups and therefore similar permanent influences in the N–C linkage would be expected in this case.

In addition to the deactivating influence which the electromeric effect sometimes shows in the benzene series and to Dr. Sutton's very significant dipole results, which were mentioned by Prof. Bennett as requiring such a permanent effect, Prof. Lapworth has insisted that the effects of substituents on equilibria require such a factor most clearly and he has also concluded that as far as this effect is concerned methyl operates similarly to the other *o*-*p*-directive groups but to a different extent. He writes this permanent factor in both cases as  We also regard as very significant the *o*-*p*-directive power of $-CH_2Cl$ which depresses the dissociation constants of aliphatic acids into which it is introduced and for which the use of the inductive effect as a directive mechanism appears quite unsatisfactory.

It is to be noticed that as soon as an important permanent electron repulsive effect is ascribed to groups like –OMe or halogen, this confuses the conception of an inductive effect transmitted by electronic mechanisms, and it appears to be necessary to regard it, as Prof. Lapworth has done, as essentially externally transmitted (*i.e.*, as a field effect).

No new symbolism is required by this view and we have



Primary effect. Electromeric effect. Field effect.

The first two effects arise mainly from the fact that the substituents are composed of atoms, the electrons of which are subject to quantum laws, and the last from the charges (dipole or ionic) which are associated with nearly all substituents. The view that the first effect arises only from the "unshared" electrons is too narrow, as a comparison of the quantum views of the structures of methyl and the halogens shows. Hückel in his quantum treatment of the effect of substituents on benzene (Z. Physik, 1931, **72**, 310) made an initial error in starting from dipole effects instead of from the atomic nature of substituents.

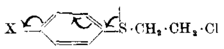
Mr. M. G. Evans said: Mulliken's idea of the "condensed atom" state as applied to simple hydrides such as CH_2 and BH_3 can be applied to the *o*-*p*-directing groups. These simple groups are not considered as a collection of separate atoms which retain their identity, but rather as a new "atom" in which the "outer electrons (*i.e.*, other than the 1*s* electron) of all the atoms making up the group are associated with the group as a whole, irrespective to which atom they originally belonged. If the groups $-CH_3$, $-NH_2$, –OH, and –F are expressed in this condensed atom form they are all found to simulate the structure of fluorine, and there is no reason to suppose that $-CH_3$

and fluorine as substituents in the benzene ring should not be very similar in action. In special cases of NH_3 and H_2O where because of the so-called "lone pair" of electrons a change in valency is possible, Mulliken considers that the hydrogens are embedded in the $2p\pi$ and to a lesser extent in the $2s$ wave functions. The $2p\sigma$ electrons avoid the neighbourhood of the hydrogen nuclei, but may be stabilised by the approach of another nucleus (*e.g.*, H^+). It may be possible to conceive of the benzene group partially stabilising the $2p\sigma$ electrons of the $-NH_2$ or $-OH$ structure—a complete stabilising would involve a change to the quinonoid form.

We might therefore expect a gradual decrease in the strength of the bond between these substituent groups and the benzene nucleus as we pass from fluorine or $-CH_3$ to $-OH$ to $-NH_2$, and the work of Klingstedt *on the ultra-violet absorption spectra of these compounds* seems to give some support to this.

Prof. Bennett agreed that the reacting atom in the aryl chlorosulphides examined does not lie within a simple conjugated system: the authors had never suggested that it did. On the other hand, benzyl bromide is surely to be regarded as an extended allyloid system (J., 1926, 404).

Prof. Robinson's suggestion of a polarisation of the type



permitted to the greatest extent when X is iodine, might account for an inverted order for the halogens in reaction (*a*), but it does not explain how these same chlorosulphides can undergo reaction (*b*) *without* any such anomaly appearing. Moreover, the various instances among halogenated benzyl halides would still remain unexplained. Why is *p*-fluorobenzyl bromide hydrolysed, not merely faster than the chlorobenzyl bromide, but twice as fast as benzyl bromide itself, the speed for nitrobenzyl bromide being very much smaller (J., 1926, 214)?

As regards the series N, O, Hals. for *o-p* directive power, a case could also be made out for including CH_3 with these, but this was not regarded as an argument for complete identity of mechanism of reaction. The fact that a double bond from nitrogen or oxygen to carbon is a normal occurrence and one between a halogen and carbon unknown, is a good reason for breaking the above series if an actual increase of covalency is suggested.

Benzotrichloride should not be thought to be liable to *o-p* substitution according to the views put forward. The chlorine–carbon partial dipoles are all inclined at 55° to the main axis and have their positive ends located on the carbon atom outside the conjugated system of the nucleus. Consequently the lines of force leaving the chlorine atoms must in the main terminate on the extra-nuclear atom referred to, and the field will not be such as to favour the *o-p* directive process.

Prof. R. Robinson said: Prof. Bennett draws particular attention to the case of hydrolysis of *p*-fluorobenzyl bromide which proceeds actually faster than benzyl bromide itself. He is perfectly correct in stating that the speaker would attribute the ease of hydrolysis of benzyl bromide to the operation of an *allyloid* system, but in the case of the fluoro-derivative the hetero-enoid system is still not directly concerned in the same sense that it is in substitution reactions. The enhanced velocity of fluorobenzyl bromide hydrolysis can hardly be attributed to the hetero-enoid system, because it would appear that this must be assumed to overpower the inductive effect of the fluorine and consequently fluorobenzene should nitrate faster than benzene. Possibly the latter experiment is not available, but analogies indicate pretty clearly what result we may expect. *The speaker does not exclude the hetero-enoid* effects in these cases; indeed, he is convinced that they are powerfully operative in such examples as *p*-methoxybenzyl bromide, but he considers that the small effects *discriminating the halogens probably originate* in circumstances not directly related to the electromerism or at least related only in some such way as discussed above.

It was further pointed out that the coherence of the hetero-enoid systems in the benzyl halides is not of a high order; the side-chain is able to orient definitely addition of hydrogen chloride to an attached double bond, but its directing influence on substitution in the benzene nucleus is of an altogether inferior order.

The papers by Prof. Ingold, Dr. J. W. Baker, and Prof. H. M. Dawson were then read, and were followed by discussion.

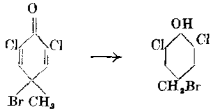
Owing to the lateness of the hour Prof. Kenner's contribution could not be given in full. It was concerned with the following points:

(1) Attention was directed to the importance of $\alpha\beta$-changes as factors in determining the result of substitution reactions. Whilst the pinacone and other changes of the Wagner–Meerwein type involve the migration of a group with a pair of electrons to an adjacent positive centre, there is another class in which an atom or group moves without electrons from a positive to a negative centre. The conversion of acylbenzyldimethylammonium salts into acylphenylethyldimethylamines in presence of sodium ethoxide (Stevens, J., 1928, 3197; 1930, 2107, 2119) is a clear case of the kind:

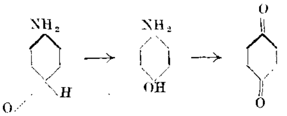
$$\left(\begin{array}{c}Ph{\cdot}CO{\cdot}CH_2{\cdot}NMe_2\\ |\\ CH_2Ph\end{array}\right)OH \longrightarrow \begin{array}{c}Ph{\cdot}CO{\cdot}CH{\cdot}NMe_2+H_2O.\\ |\\ CH_2Ph\end{array}$$

The formation of ketones and quinones from aliphatic *aci*-nitro compounds and 2 : 6-dinitrophenols, respectively, and of 3 : 5-dinitroanisole from 1 : 3 : 5 trinitrobenzene, as well as a number of other reactions have already been treated from this point of view (Jones and Kenner, J., 1931, 1842), and it would seem that the formation of *o*-nitrophenol from nitrobenzene (Wohl, *Ber.*, 1899, **32**, 3486) and the various reactions of nitro-compounds with potassium cyanide are further instances. Thus, *meta*purpuric acid is obtained from 2 : 4-dinitrophenol (Borsche and Böcker, *Ber.*, 1904, **37**, 1848):

The isomerisation of keto-bromides to pseudophenols under the influence of hydrogen ions (Fries and Oehmke, *Annalen*, **462**, 1):



and the oxidation of phenol and of aniline to *p*-hydroxy-derivative (precursors of quinone) are further illustrations:

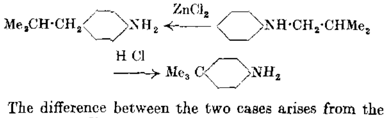


In this connexion, and in view of the recent suggestion by Baddeley and Bennett (*J.*, 1933, 267) that haloid benzenes differ in this respect from phenol and from aniline, it is emphasised that chlorobenzene is convertible by nitric acid in presence of mercury salts into chloronitrophenol and picric acid (D.R.P. 194,883), whilst bromobenzene undergoes biochemical oxidation to *p*-bromophenol (Baumann and Preusse, *Z. physiol. Chem.* 1881, **5**, 309). The formation of 3 : 5-dinitro-*p*-cresol from toluene similarly has long been known (Noelting, *Ber.*, 1885, **18**, 2670).

(2) It would seem that radicals, rather than ions, are produced more frequently in organic reactions than is usually realised. In many cases the ultimate result is the same whether ions or radicals are formed. Thus, aldehydes result from alkoxide anions (compare Kenner, *Ber.*, 1932, **65**, 705), as well as from alcohol by a chain reaction initiated by hydroxyl (Taylor and Gould, *J. Amer. Chem. Soc.*, 1932, **55**, 859):

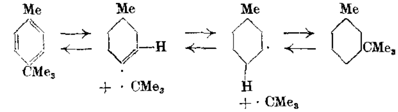
$$CH_3{\cdot}CH_2OH + OH \rightarrow H_2O + CH_2CH_2O \rightarrow CH_2CHO + OH$$

In other cases differences can arise. Whilst, for instance, alkyl radicals preserve their structure, the corresponding kations are very liable to isomeric change. Hence the conversion of *N*-*iso*butylaniline into *p*-*iso*-butyl- and *tert.*-butyl-aniline in presence of zinc chloride and hydrogen chloride, respectively (Hickinbotham and others, *J.*, 1930, 1558, 1566), is attributable on the one hand to a reaction involving radicals and comparable with the benzidine change (compare Jones and Kenner, J., 1932, 711), and on the other to one involving ions:



The difference between the two cases arises from the greater co-ordination demand on the nitrogen atom by proton than by metal cation.

In this connexion, it is noteworthy that aluminium chloride facilitates the formation of radicals from aromatic compounds, as in Scholl's preparation of dinaphthyls from naphthalene derivatives. The reaction which is assisted by *o-p*-directive substituents, must be associated on the one hand with the classical experiments of Anschuton and Immendorf (*Annalen*, 1886, **235**, 189) on the conversion of alkylbenzenes into more highly alkylated derivatives, and on the other with the apparent *meta*-substitution of alkylbenzenes by alkyl halides, in presence of aluminium chloride (compare Becke, *Ber.*, 1890, **23**, 3191; Ulhorn, *ibid.*, 3142; Heise, *ibid.*, 1891, **24**, 769; Shoesmith, J., 1930, 2231). It is therefore, now suggested that this latter reaction depends on primary formation of *para*-derivative and its conversion into *meta*-isomeride by way of the corresponding radicals:



Some experimental evidence, in accord with this view, is already available (Heise and Tohl, *Annalen*, 1892, **270**, 165), but it will be desirable to confirm and amplify it.

(3) Cationoid *meta*-*substitution* was regarded as of two types, corresponding to those of *o-p*-substitution. Whilst the cases of negative poles may be treated in the manner of Allan, Oxford, Robinson, and Smith (J., 1926, 409), those of nitrobenzene, carboxyl compounds, etc. are compared with the α-substitution of analogous aliphatic compounds, which the experiments of Leuchs (*Ber.*, 1913, **46**, 2435; 1914, **47**, 2528; 1915, **48**, 1015) show can occur directly rather than by enolisation. This was attributed to a condition of the molecule intermediate between its ketonic and its enolic forms, in which a negative change is distributed in the manner demonstrated by Kuhn for *aci*-nitro-compounds (*Ber.*, 1927, **60**, 1297). A similar condition was postulated for aromatic nitro- etc. derivatives and the intramolecular oxidations of *o*- and *p*-nitrotoluenes in presence of alkali were regarded as experimental evidence of such a possibility (compare Jones and Kenner, J., 1931, 1842). Such oxidations bear the same relation to other substitution processes as was previously indicated for *o-p*-substitution, and since the carbon atoms affected are terminal, the mechanism suggested by Allen, Oxford, Robinson, and Smith is inapplicable to them. The α-oxidation of carbonyl compounds by selenium dioxide (Riley and others, J., 1932, 1881) supplies the aliphatic counterpart of these reactions. Acids catalyse both the ordinary reactions of carbonyl compounds (compare *e.g.*, Conant and Bartlett, *J. Amer. Chem. Soc.*, 1932, **54**, 2881), and their enolisation (K. H. Meyer, *Annalen*, 1911, 380, 238), doubtless by oxonium salt formation (compare, *inter alia*, Baeyer and Villiger; Baker, J., 1931, 397; 1932, 122) and may therefore be expected not merely to "enhance the *meta*-directive power" (Baker and Moffitt, J., 1931, 315), but also to assist the generation of the condition of distribution favourable to substitution. It is in accord with this that Hetherington and Masson have recently found the nitration of nitrobenzene to involve such an oxonium salt (J., 1933, 105).

The discussion was summarised by Prof. Robinson. Owing to the lateness of the hour, reference to the many interesting points raised by the speakers in this discussion could not be made, but in regard to Prof. Ingold's helpful contribution it was remarked that the apparently opposing inductive and electromeric effects of the halogenes do not imply any contradiction quite apart from the idea of time-dependence of the electromeric effect which has frequently been invoked by the speaker in explanations of reactions, and which is now regarded by Prof. Ingold as of fundamental importance. The point is that the inductive effect does not give rise to the production of unshared electrons, and thus in the absence of some activating process in which covalency electrons break away from one of the atoms sharing them, inductive effects should not give rise to active molecules or to the formation of new covalencies. On the other hand, electromeric effect inevitably produces a change in the degree of sharing of electrons, and thus it implies the formation of active molecules and the site of the unshared electrons determines the orientation of the reaction. The unshared electrons produced in the electromeric process may be under the influence of a powerful positive electrical field, and yet be capable of taking part in a reaction, although it is true it will be a slow one if the de-activating field is strong.

On the general question of the development of theories in this branch of chemistry, the speaker suggested that there was a danger of an attempt to fill in all the details on the canvas at a stage when only the broad outline of the picture was discernible; the interesting papers of Drs. Shoppee and Baker were examples of the complexity of the problem, and whatever may be said of equilibria, probably the soundest method of attack, it was certain that the method of comparison of reaction velocities was open to grave theoretical objections, and that it was exceedingly difficult to discriminate between the different factors as to which of them was producing the results observed. The speaker was definitely convinced that an undesirable attempt is being made to force the pace and that fundamental researches of the type described by Prof. Dawson represent the most secure method of progression.

In making these remarks he was not specifically referring to Prof. Bennett's work, for in that case the gross effect of a mass of data all tending in the same direction must be recognised.

The sixth Hugo Müller lecture was delivered on May 25 by Prof. H. E. Armstrong, F.R.S., who chose as his subject "Chemistry at the Cross Roads." The president, Prof. G. T. Morgan, O.B.E., F.R.S., who occupied the chair, referred to the origin of the lectures, and to the fact that the lecturer was formerly a colleague and friend of Dr. Hugo Müller.

After the lecture the president said that chemists should bear in mind the lecturer's criticisms and should return to simplicity of thought.

Prof. J. F. Thorpe, proposing a motion for a vote of thanks to the lecturer, said that he had envisaged the whole field as no one else could. Prof. A. Smithells, seconding, said that his critical faculty was always applied in aid of the progress of science. The motion was carried with acclamation and was briefly acknowledged by Prof. Armstrong.

BRITISH ASSOCIATION OF CHEMIS

The 15th annual meeting of the London Sec the British Association of Chemists was held at the Street Station Restaurant on Friday, May 1 H. M. Morgan, the retiring chairman, presided.

The report of the committee emphasized the g strength of the Section and the close co-opera the committee to secure increase in membershi increase numbered 69, the total membership Section now being 712.

The chairman in his remarks emphasized the ance of the new Pharmacy and Poisons Bill, whicl revise the law so that those who practised ch as distinct from pharmacy would now be able themselves chemists. The Association had b least indirectly instrumental in making this p Mr. Morgan introduced Mr. Mellersh as the new man of the Section. He said that the committ to be congratulated upon the appointment Mellersh, who was a committee member of long st and a loyal supporter of the Association.

Mr. C. B. Woodley, the general secretary, sa despite the depression in industry the Associati made excellent progress in all directions. In t of appointments, for example, 1460 had been during the past year, an increase of 50% on the p year. In the matter of legal aid for memb record was excellent. Every case dealt with ha satisfactorily settled, and salary recovered by m as a result of legal advice and aid was £246 Uemployment Benefit Fund had now paid ou since its inception. In his view the next step consider the organization of a pensions fund.

Mr. S. R. Price, past-president of the Asso said that the progress of the London Section was now by far the largest, had been remarkab thought that the Association had made greater during this year than ever before. It was bei recognized by the other societies. This advan due to the closely co-ordinated work of the comm

The meeting was followed by a smoking which was greatly appreciated by the commit all members present.

CERAMIC SOCIETY

The spring meeting of the Ceramic Society, meeting of all sections, was this year varied fr usual plan of having a single centre. Works at St and Stourbridge were visited on the first day, the works in Lancashire on the second day, followin all parties assembled at the Majestic Hotel, St. where the banquet took place in the evenin business meeting was held in the same hotel following day, May 6, the programme presentin interesting features though the number of contri was not as great as on most occasions.

Dr. F. V. Tideswell read a paper on "The Cons of Coal," which was concerned mainly with the scopical aspect of coal.

The preparation of slices of coal thin enoug transparent presented difficulties, but improved r had recently been devised resulting in cons

.vances in regard to the structure and mode of forma-)n of coal. In microscopic sections, coal was found to hibit a marked, banded *structure, from whatever* ·ality obtained.

The chief component of bright coal was called clarain, d associated with this were varying proportions of a .ssy substance termed vitrain. Dull coal was composed durain or fusain which had undergone more modifica- n than vitrain. Broadly speaking, bright coal could said to consist of comparatively coarse fragments of getable debris, mainly of woody matter, whilst dull al (durain) was composed of comparatively small agments of vegetable remains also mainly woody in ture. The lecturer expressed his belief that continued vestigation would result in establishing definite lationship between the constitution of different coals d their values as fuel.

The following paper was read by F. West, M.I.Mech.E., " The Winning and Transport of the Basic Raw aterials used in the Heavy Clay and Refractories dustries." This paper dealt with the materials worked North Derbyshire, viz., pocket silica and clay worked open pits. The pits *were in very hilly country at* stances of half-a-mile to 16 miles from the works, and e storage bins at the works were large enough to ld at least 12 weeks' requirements.

The original working was by hand, using trucks and im horses for transport. The horses were replaced by comotives, and excavators and machinery were put wn in the pits. The first locomotive paid for itself *two and a-half years, and the first excavator in less* an two years' working. Examples of comparative sts were given.

F. Gwynne Vevers then spoke on " The Winning and ansport of Clay." This paper dealt with the means ployed in the South-West, *where the works were* mparatively small, and the clay face was unsuitable the use of a mechanical digger. The clay was cordingly " got " by pick and shovel. At the Catty- ook works the varying nature of the clay made erations difficult and costly, because certain strata d to be avoided altogether or carefully mixed. The our cost of getting clay at Cattybrook amounted to 6d. per *1000 bricks, and there was the additional* *st of the air compressor drill, blasting powder, and* petrol runabout.

In the Bridgwater district every firm except one itinued to use the old hand method for winning and nsporting clay. The single firm has practised the w method of mechanical digging since 1930. The idgwater clay beds included, in descending order, rown *mild clay, a strong tile clay, and a soft blue* y, this latter being mixed with the brown mild clay making bricks.

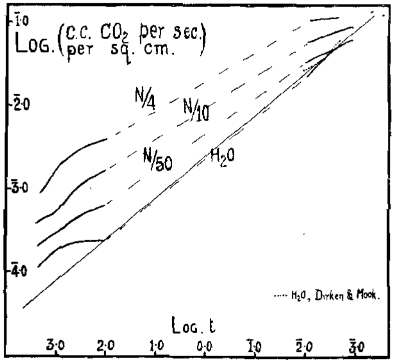
The final contribution was by F. H. Clews, M.Sc. and T. Green entitled " The Permeability of Refractory terials to Gases," which has been printed in Bulletin of the Council of the British Refractories Research sociation.

The literature on the permeability of refractory oducts was reviewed and the results summarized, and paratus was described for measuring the permeability test pieces 6 cm. in diameter. It was proposed to use this later for measurements at high temperatures. The results of the permeability measurement for 16 *representative products were considered in relation to* their textures. The absence of uniformity of pore *distribution in a single brick was emphasized particularly* with relation to (*a*) lamination, (*b*) the occurrence of denser surface layers originating in the drying or early firing of the goods, (*c*) the presence of a surface skin. A rough classification of the average pore size was outlined.

CORRESPONDENCE

THE RATE OF ABSORPTION OF GASES BY LIQUIDS

SIR,—During the course of some experiments involving *the absorption of carbon dioxide from a gas stream in* a counter-current tower, it became evident that the rate of absorption was extremely small when compared with the theoretical rate of impact of carbon dioxide molecules on the liquid surface. It was inferred that *slow diffusion through the liquid surface accounted for* the slow absorption rate, and therefore, that the age of the liquid surface should be an important factor affecting



the rate of absorption. Rough experiments with falling drops confirmed the inference.

The same conclusion may be drawn from the work of M. N. Dirken and H. W. Mook,* who have measured the amount (*m*) of carbon dioxide absorbed up to time (*t*) by water and several aqueous *solutions in liquid jets* whose surface age was in the range 0·01 to 0·001 second. *They showed that the formula* $m = 2c_0 \sqrt{\frac{Dt}{\pi}}$ *derivable the theory of diffusion, agreed with their results for* water ; and that (D), the diffusion constant calculated therefrom, was in fair agreement with previous deter- minations to (D) by other methods.

I have recently measured the rate of absorption of carbon dioxide (from gas cylinders) by water and aqueous solutions of sodium hydroxide at room temperature and pressure in the ranges 0·01 to 0·001 sec. and 1 min. to 1 hour. The results are plotted in the diagram as the

* Biochem. Z., **219**, 452, 1930.

logarithm of the absorption rate against the logarithm of time. For comparison, a continuous straight line is drawn at a slope of ½, as deduced from theory.

It is obvious that the age of the surface is of prime importance in any general investigation of the nature of absorption of gases by liquids, and the effect of this factor is being explored in work now in progress.

ROBT. C. BRIMLEY

Cambridge
May 25, 1933

PERSONAL AND OTHER ITEMS

Lord Melchett is to become president of the British Science Guild in succession to Sir Samuel Hoare, whose three-years term of office expires shortly. Lord Melchett will be elected president at the annual meeting of the Guild to be held at the Mansion House on June 19.

Dr. W. M. Cumming, M.I.Chem.E., F.I.C., a member of the Society, at present senior lecturer on organic chemistry in the Royal Technical College, Glasgow, and formerly with the British Dyestuffs Corporation, Ltd., has been appointed to the Young Chair of Technical Chemistry in the College.

The honorary degree of D.Sc. will be conferred by the Oxford University on June 21 on Dr. J. S. Haldane, F.R.S., Fellow of New College, Oxford, and honorary professor and director of the Mining Research Laboratory, Birmingham University.

Mr. F. P. Bowden has been re-appointed demonstrator in chemistry at Gonville and Caius, Cambridge, for a further period of five years. Mr. R. G. W. Norrish has also been reappointed Humphrey Owen Jones Lecturer in Physical Chemistry at Emmanuel College, Cambridge. The University has appointed Dr. E. Mellanby Emmanuel, to the post of Sheild Professor of Pharmacology, the professorship having been established in memory of Mr. H. M. Sheild, of Downing College, who bequeathed a trust fund to the Medical School of the University to be used at their discretion; the office will terminate after the three years of Dr. Mellanby's appointment.

Mr. L. Jacobs has been appointed to a research scholarship in physical chemistry at Trinity College, Cambridge.

Mr. J. A. Frome Wilkinson was re-elected president of the Oil and Colour Chemists Association at the fifteenth annual meeting held recently. The vice-presidents of the Association for the ensuing year are Messrs. T. H. Barry, A. A. Drummond, G. A. Campbell, S. R. Hall, and Noel Heaton.

We regret to learn of the death recently in America of Dr. J. G. Hibben, president of Princeton University from 1912 to 1932.

The University of Wales has awarded the degree of D.Sc. to Dr. Alan E. Bradfield for research in the department of chemistry.

Sir John Jackson, O.B.E., late Deputy Chief Inspector of Factories, who died on March 19, left estate of the gross value £3,287, with net personalty £3,098.

Mr. G. W. Malcolm, managing director of the Salt Union, Ltd., left estate of the gross value £16,899, with net personalty £11,678.

Sir Henry Royce, the noted engineer, who died in April last, left estate of about £110,000, and the trustees of his will are directed to apply one-tenth of his estate in making provision for research work.

Leverhulme Research Fellowships

The first Lord Leverhulme, who died in 1925, directed in his will that the income from part of his estate should be devoted to scholarships for research and education. The trustees, who have since made grants for this purpose to several institutions, have now resolved to apply £12,000 annually to the establishment of research Fellowships. A committee for the selection of the Fellows has been formed by Dr. H. J. W. Hetherington (chairman), Sir William Hardy, F.R.S., Mr. H. T. Tizard, F.R.S., Prof. H. M. Carr-Saunders, and Dr. N. V. Sidgwick, F.R.S., and Dr. L. Haden Guest has been appointed secretary.

No subject of inquiry has been excluded from the scheme, but the Fellowships are intended in the first instance to assist experienced workers, particularly those who are prevented by pressure of routine or other causes from undertaking or completing investigations of value. No definite limit will be placed on the individual grants, but the duration of the Fellowships will normally not exceed two years. The committee will meet in July to consider the first awards, and applications for such consideration will be received up to June 19. Full particulars can be obtained from the secretary, Leverhulme Fellowship Scheme, Union House, St. Martin's-le-Grand, London, E.C.1.

Development of a New Fertilizer

A double nitrate of calcium and magnesium is reported to have been developed in France as a fertilizer (Die Chemische Industrie, Apr. 29). It contains 15% of nitrogen, 7% of water-soluble magnesium, and 16% of water-soluble calcium. The new product is sold at the same price as sodium nitrate.

Anglo-Palestine Exhibition

An Anglo-Palestine exhibition, the first of its kind, is to be held in London at the Royal Agricultural Hall, from June 7 to 17, 1933. It will include a section dealing with present activities in Palestine and its commercial development, whilst a British Section, covering 93,000 square feet, is designed to establish contact between producers in England and buyers abroad. The president is Lord Reading, and amongst the distinguished persons giving the exhibition their support are Lord Melchett, Sir Hugo Hirst, and Lord Burnham. The organization of the exhibition is being conducted by Ewart Watson Exhibitions, Ltd., 19, Charing Cross Road, London, W.C.2.

Estimation of Bismuth in Copper

Various developments have recently taken place in the metallurgy of copper and brass which have made the effect of small proportions of bismuth assume a greater importance than before. Simultaneously, several sources of copper are being developed which may contain more or less bismuth, and with this bismuth content affecting

the sale of many thousands of tons of copper per annum it is obviously essential that there should be available an entirely reliable method of analysis. The Fiscal Policy Technical Sub-Committee of the Brass and Copper Industries has made a careful examination of the whole subject, and as a result has put forward a set of principles by which a competent analyst should be able to obtain reliable and reproducible results in estimating bismuth content up to 0·02%.

Gravimetric means are considered unsatisfactory in estimating such small amounts, and the colorimetric method is put forward as the best available, employing the bismuth sulphate–potassium iodide reaction, the product of which, bismuth triiodide, dissolves in an excess of potassium iodide to give a yellow colour. In this method the copper is first dissolved in nitric acid, any insoluble residue being ignited and fused with potassium bisulphate, the fusion dissolved in dilute sulphuric acid and added to the original filtrate. In order to ensure that the whole of the bismuth is precipitated during separation, it is necessary to have present a sufficient quantity of another element to act as a collector, and iron is considered the most satisfactory, a specific addition of ferrous ammonium sulphate being proposed. The method details the precipitation of the hydroxides of bismuth and iron, solution of the two, and reduction of the iron to the ferrous condition with sulphuric acid. The final solution is then matched against a blank solution prepared by carrying through all the analytical operations as applied to the sample under assay, but to which no sample has been added. Into this resulting solution a standard bismuth solution (containing 0·0001 g. bismuth per c.c.) is added until the colours match.

Full details may be obtained from Mr. Lester Smith, c/o Squiers & Co., King's Court, 115, Colmore Row, Birmingham, to whom also suggestions and comments should be sent.

Research at the Mellon Institute

The twentieth annual report of Dr. E. R. Weidlein, Director of the Mellon Institute for Industrial Research, covers a period when commercial depression has had a considerable effect on industrial research. It is of much interest therefore to note that, rather than any falling off in the useful work of the Institute there appears to have been even wider scope in this work, and many good services have been rendered to American chemists in finding, encouraging, and making posts in industrial concerns for scientific men.

During the year nine new fellowships began operation, concerned with cast iron, safety glass, lubricants, phytochemistry, detergents, graphite, anthracite, oral hygiene, and smoke abatement. Other fellowships have continued and much useful information has been made available. Attention has been given to atmospheric pollution; a cement coated steel has been evolved for building purposes; several new materials have been evolved for the conditioning of textile fibres; work on adhesives for packaging has gone forward; a new process for treating chrome-tanned kid leather has been developed to give greater durability and waterproofness: further uses for sugar are being investigated and seem likely to yield valuable results; and in the department of pure chemistry much work has been done on the preparation and properties of a number of substances of commercial importance. Copies of the report can be obtained free from the Mellon Institute, University of Pittsburgh.

Anglo-German Trade

An Anglo-German Trade Association has been formed in London possessing an advisory council and an advisory committee which comprise experts from all representative trades and industries. Among the members of the advisory council are: Sir John S. Allen, M.P., Mr. A. E. Chorlton, M.P., Sir Philip Dawson, M.P., Sir Newton J. Moore, Maj. R. B. Thomas, M.P., and Sir William Wayland, M.P. Any persons interested in trade with Germany may obtain further particulars by writing to the Chairman, Mr. S. W. Hymans, 3, Gordon Square, London, W.C.1.

Trade Agreements with Norway and Sweden

The texts have recently been published of two further trade agreements concluded by the British Government with the Governments of Norway and Sweden. In the agreement with Norway, the British Government makes concessions in respect of imports of Norwegian fish and other foodstuffs, and amongst materials from Norway to be imported duty-free are included calcium carbide and cyanamide, ferro-chromium, ferro-manganese, ferro-silicon, iron pyrites, unwrought nickel, silico-manganese, nitrate of lime, titanium ores, and vanadium–titanium pig-iron, whilst preferential tariffs are granted in respect of whale oil, road-making materials, iron and steel not referred to in Schedule I of the Import Duties Order, 1932, crude iodine, unwrought aluminium and zinc, and ammonium nitrate, nitric acid, and fatty acids other than grades referred to in the Schedule to the Safeguarding of Industries Act, 1921. In return for these concessions the Norwegian Government undertakes to import 70% of its total coal requirements from England (as compared with 38% in 1931), and the import duties are removed or lowered on a number of textiles, china clay, varnishes, rubber and rubber latex, machinery, fabricated iron and steel, salt, and other products.

The agrement with Sweden is in many features similar to that with Norway, the Swedish Government guaranteeing a minimum importation of British coal of 47% of the total imports, representing an increase of about 1,000,000 tons per year as compared with the 24% imported in 1931. Thirteen classes of goods are guaranteed free entry into Sweden, including coal, tinned plate, china clay, phosphorus, red lead, and asphalt varnish, whilst the undertaking is given not to increase the existing duty on 57 other classes of goods, including textiles and machinery. The British concessions to Sweden include reductions of duties on certain classes of iron and steel imports, raw granite, and ferro-chromium and other special steels.

Production of Synthetic Acetic Acid in Japan

The Ibigawa Electric Co., at Ogaki, and the Japanese Nitrogen Co. at Minamata are reported to be producing synthetic acetic acid from calcium carbide. The last-named company is also making acetic anhydride and is proposing to start production of cellulose acetate

silk (*Die Chemische Industrie*, May 13). The production of synthetic nitrogen compounds in Japan in 1931 is given as 246,000 t. of pure nitrogen. This is in the hands of twelve undertakings, one of which, the Nippon Chisso Hiryo, is stated to be manufacturing nitric acid by the oxidation of ammonia, and to have a plant with a capacity of 12,000 t. a year, which covers 80% of the internal requirements of the country.

Development of the Spanish Potassium Industry

The production of potassium salts in Spain has risen from 18,700 t. (of potassium) in 1929 to about 60,000 t. in 1932. Spain now ranks third as a producing nation (after Germany and France, but before Poland and the U.S.A.). A large proportion of the potassium salts is exported. In 1932 66,000 t. were exported, 23,270 t. going to Sweden and 10,634 t. to the U.S.A.

Work on Coal Products in Germany

During the post-war years much work has been done in Germany on the technology of production of the many materials obtained from coal, and a large part of the credit for this work is due to the Gesellschaft für Kohlentechnik m.b.H., of Dortmund-Eving. The second number (volume 4) of the *Berichte* of the Gesellschaft this year contains an interesting and concise account of this work in the fourteen years December, 1918—December, 1932, contributed by the well-known writer on the subject, Prof. W. Gluud. The first part of this account describes the establishing of the Society in 1918 and its growth in the succeeding years, the firms which have contributed to the work, and the personnel engaged on it. An interesting comparison is given of the premises occupied in 1920 and the much more spacious ones now used. The next part of the article deals with the work which the society has undertaken with regard to ammonia, ammonium compounds, gas, coke, motor spirit, etc., produced from coal and the results obtained are indicated in a valuable list of patents which have been taken out. In a final section, Dr. Gluud shows how the work has developed during the 14 years under review. The whole article forms a document of some historic as well as scientific interest, and it should be valued in other countries as an excellent summary of work in this field in Germany.

Import Trade of India

A survey of the Import Trade of India for the nine months April—December, 1932, prepared by H.M. Trade Commissioner in Calcutta, states that the value of imports increased by Rs. 7 crores (£5,250,000) or 8% compared with the corresponding period of 1931. The total exports, including re-exports, fell by Rs. 22 crores or 18%. The trade in chemicals continues to expand, the total imports increasing from Rs. 187,50,000 to Rs. 208,75,000 due principally to increased imports of sodium carbonate, caustic soda, and potassium chlorate whilst the value of imports of drugs and medicines shows only little change at Rs. 138,25,000, the principal imports in this class being camphor, quinine salts, proprietary medicines, and saccharine. There was a slight increase in the paints and colours trade from Rs. 48,00,000 to Rs. 50,50,000, the United Kingdom's share being about 60%. There were increased imports from the United Kingdom of textiles, textile machinery, sugar machinery, and motor cars.

MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.

The following alterations in prices are reported since the publication of the last Market Report (cf. CHEM. & IND., May 12, 1933, p. 427).

TAR PRODUCTS

Xylol.—1s. 10d.—1s. 11d. per gal. Pure, 2s. 1d.—2s. 2d.

Creosote.—B.S.I. specification, 3d. per gal., d/d. Heavy—4d. per gal.

Naphtha.—Solvent, 90/160, 1s. 4d.—1s. 5d. per gal. Solvent 95/160, 1s. 7d. per gal. Solvent 90/190, 9d.—1s. 1d. per gal.

Pitch, medium, soft.—85s. per ton, in bulk at makers' works.

Pyridine.—90/140—3s. 9d.—4s. 6d. per gal.; 90/180—2s.—2s. 3d. per gal.

Toluole.—90%, 2s.—2s. 1d. per gal. Pure, 2s. 4d. per gal.

PHARMACEUTICAL AND PHOTOGRAPHIC MATERIALS

Cadmium Iodide.—14s. 6d. per lb.

Iron Quinine Citrate, B.P.—9¾d.—1s. 0½d. per oz., according to quantity.

Sod. Barbitonum.—13s. 9d.—15s. per lb.

Eugenol.—7s. 3d. per lb. Geraniol (Palmarosa).—17s. per lb. Geraniol.—6s. 6d.—11s. per lb. Heliotropine.—6s. per lb. Iso Eugenol.—8s. 6d. per lb. Linalol.—(*ex Bois de Rose*) 6s. 3d. per lb.—(*ex Shui Oil*) 5s. 9d. per lb. Linalyl Acetate.—(*ex Bois de Rose*) 8s. 3d. per lb.—(*ex Shui Oil*) 7s. per lb.

ESSENTIAL OILS

Almond.—Foreign S.P.A., 9s. per lb. Anise.—2s. 1d. per lb. Araucaria, 8s. 6d. per lb.—Bergamot—6s. 6d. per lb. Bourbon Geranium.—25s. 3d per lb.

Camphor.—Brown, 80s. per cwt.—White, 85s. per cwt Cananga, Java, 10s. per lb. Cinnamon Oil.—3s. 6d. per lb. Cassia, 80/85%, 4s. 6d. per lb.

Citronella Oil.—Java, 2s. 9d. per lb. Ceylon, 2s. 3d per lb. Clove.—90/92% English, 4s. 9d. per lb.

PATENT LIST

The following is a list of complete specifications of chemical interest which are open for inspection under Section 91 (4) (*a*) of the Patent Acts. Printed copies are not available, but photographic copies may be obtained at a charge of 8d. per page (minimum 1s.) from the Patent Office, Chancery Lane, W.C.2.

I. 23,774 (1932). Kidde & Co., Inc. Detection of suspended matter in fluid streams.

30,005 (1932). Linde Air Products Co. Articles or apparatus subject to low temperatures.

31,635 (1932). Metallges. A.-G. Removing acid constituents from gases, and rendering said constituents utilizable.

31,702 (1932). Lejeune and Bongrand. *See* V.

31,857 (1932). Ruhrchemie A.-G. Apparatus for carrying out gas reactions.

31,940 (1932). Koch. Heating systems employing hot liquids.

13,851—3 (1933). Munters. Heat insulation.

II. 9425 (1932). Laga Soc. Limitada. Providing fuel mixture from gas oil etc.

28,772 (1932). I. G. Farbenind. Conversion of masses of waxes into small pieces.

29,059 (1932). N. V. de Bataafsche Petroleum Maats. Destructive hydrogenation of carbonaceous materials.
31,635 (1932). Metallges. A.-G. *See* I.

III. 26,427 (1932). Henkel & Cie. Ges. Manufacture of alcohols.
28,890 (1932). Ruhrchemie A.-G. Producing chlorhydrocarbons.
30,405—6 (1932). N. V. de Bataafsche Petroleum Maats. Halogenation of saturated hydrocarbons.
31,667 (1932). I. G. Farbenind. Manufacture of fluorinated aromatic hydrocarbons.
32,125 (1932). Brit. Celanese, Ltd. Manufacture and use of organic compounds.

IV. 31,676 (1932). Kalle & Co. A.-G. Preparation of diazo-types.
31,855 and 32,203 (1932). I. G. Farbenind. Manufacture of azo dyes.

V. 31,702 (1932). Lejeune and Bongrand. Manufacture of filter cloths.

VI. 32,137 (1932). I. G. Farbenind. Printing or dyeing animal fibres.

VII. 29,269 (1932). Kachkaroff and Matignon. Simultaneous production of sulphuric and nitric acids.
31,635 (1932). Metallges. A.-G. *See* I.

IX. 31,686 (1932). Propper. Building materials.
31,806 (1932). Hoffmann and Hoffmann. Floorings.

X. 31,410 (1932). Krupp A.-G. Iron and steel alloys.
32,219 (1932). Allgem. Elektricitätsges. *See* XI.

XI. 15,281 (1932). Samuel. Appliances for treatment of liquids etc.
31,851 (1932). I. G. Farbenind. Manufacture of insulating materials.
32,219 (1932). Allgem. Elektricitätsges. Cores of magnetic material.

XII. 28,772 (1932). I. G. Farbenind. *See* II.

XVIII. 26,427 (1932). Henkel & Cie. Ges. *See* III.
32,215 (1932). Kalle & Co. A.-G. *See* XX.
32,216 (1932). Kalle & Co. A.-G. Manufacture of preparations of starch-degrading enzymes.

XIX. 28,977 (1932). Shellabarger Grain Products Co. Manufacturing soya-bean flour.
30,613 (1932). Hanseatische Mühlenwerke A.-G. Production of soups, sauces, etc.
31,821 (1932). California Fruit Growers' Exchange. Jelly preparation.

XX. 32,215 (1932). Kalle & Co. A.-G. Manufacture of stable pancreas—amylase dry preparations.

XXI. 31,676 (1932). Kalle & Co. A.-G. *See* IV.
31,682 (1932). Telefunken Ges. für drahtlose Telegraphie. Luminophores or fluorescent screens.
31,703 (1932). Ubertype A.-G. Production of raised photo-mechanical printing surfaces.

GENERAL NOTES

Official Trade Intelligence

The Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Brazil:* Tin and lead ingots (751). *Northern Ireland:* Disinfectants (728). *Puerto Rico:* Paint (752).

Tellurium Lead

The new tellurium-lead alloy, known as Teledium Brand Tellurium Lead, has already interested many chemists and chemical manufacturers. Information about it and samples can be obtained on applying to the *Goodlass Wall & Lead Industries, Ltd., London* House, 3, New London Street, E.C.3.

A Patent Magnetic Clutch

Thomas Broadbent & Sons, Ltd. of Huddersfield has recently produced a new magnetic clutch, suitable for power transmission in almost every type of machinery. The "C.B." magnetic clutch consists of two members, referred to as the driver and the driven. The driver is that half of the clutch in which is embodied the magnetizing coil and slip-rings for feeding it, and the driven is mounted on a spring steel plate, the engagement and disengagement of the friction surfaces depending upon the action of its flexibility. When the driver member of the clutch is magnetized by means of current passing through the coil, the other half is attracted to it, this movement being made possible by the flexibility of the steel disc already referred to. When the clutch is de-energized, the steel plate springs back to its original position, breaking direct contact between the driver and the driven. The clutches can be supplied in sizes ranging from 6½ in. to 81 in. diameter, in coupling form for direct drives, or for belt, gear, or chain drives.

PUBLICATIONS RECEIVED

GMELINS HANDBUCH DER ANORGANISCHEN CHEMIE. Edited by the German Chemical Society. 8th ed. SYSTEM-NUMMER 35: ALUMINIUM. TEIL B—LIEFERUNG 1. Pp. ix + 303. Berlin: Verlag Chemie, G.m.b.H., 1933. 48 m.; subscription, 42 m.

CLUES AND CRIME: THE SCIENCE OF CRIMINAL INVESTIGATION. By H. T. F. Rhodes. Pp. ix + 283. London: J. Murray, 1933. 6s.

GRUNDZÜGE DER CHEMIE UND BIOCHEMIE DER ZUCKERARTEN. By K. Bernhauer. Pp. xi + 365. Berlin: J. Springer, 1933. Paper, 32 rm.; bound, 33.80 rm.

PURIFICATION OF WASTE WATERS FROM BEET SUGAR FACTORIES. By E. H. Richards, B.Sc., and D. W. Cutler, M.A. Department of Scientific and Industrial Research. Water Pollution Research. Technical Paper No. 3. Pp. x + 157. London: H.M. Stationery Office, 1933. 7s. 6d.

VITAMINS AND OTHER DIETARY ESSENTIALS. By W. R. Aykroyd, M.D. Pp. 218. London: Wm. Heinemann (Medical Books), Ltd., 1933. 7s. 6d.

CONDUCTIVITY OF SOLUTIONS. By C. W. Davies, D.Sc. 2nd ed., revised and enlarged. Pp. x + 281. London: Chapman & Hall, Ltd., 1933. 15s.

REPORT OF THE NATIONAL RESEARCH COUNCIL OF JAPAN. No. 10. April, 1930—March, 1931. Pp. 351—391. Tokyo: National Research Council of Japan, 1933.

SECOND YEAR COLLEGE CHEMISTRY. By W. H. Chapin. 3rd ed., revised. Pp. xiii + 374. New York: J. Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1933. 18s. 6d.

WATER POLLUTION RESEARCH. SUMMARY OF CURRENT LITERATURE. Vol. VI, No. 5. May, 1933. Abstracts Nos. 501—643. Department of Scientific and Industrial Research. Pp. 145—180. London: H.M. Stationery Office, 1933. 2s.